$(36-31.736)\div 2=2.132$ in. thickness of shell.

This problem was solved with same result, by *Hon. Josiah H. Drummond, J. F. W. Scheffer, Frank Horn J. K. Ellwood, and Cooper D. Schmitt.*

39. Proposed by P. C. CULLEN, Superintendent of Schools, Brady, Nebraska.

A, *B*, and *C* start from same point at same time. *A* north at rate of three miles per hour. *B* east at rate of four miles and *C* west at rate of five miles per hour. *B* at end of two hours starts at such an angle as to intersect *A*. How long after starting must *C* start north-west in order to meet *A* and *B* at common point?

Solution by HON. JOSIAH H. DRUMMOND, LL. D., Portland, Maine, and J. W. WATSON, Middle Creek, Ohio.

Let x be the time after *B* turns till he meets *A*. The route of both is a right angle triangle with base 8; perpendicular $3x+6$, and hypotenuse $4x$. Hence, $16x^2=(3x+6)^2+64$, whence $x=7\frac{1}{7}$ or -2. But the -2 value makes them turn back and meet at point of starting. Let y=time before *C* turns. Then $7\frac{1}{7}+2-y$=time after he turns. $3x+6=1\frac{2}{7}\frac{2}{7}$=perpendicular, $5y$=base, and $5(\frac{6}{7}\frac{4}{7}-y)$=hypotenuse. Hence, $25y^2+(\frac{1}{7}\frac{9}{7}\frac{2}{7})^2=25(\frac{6}{7}\frac{4}{7}-y)^2$, whence $y=2\frac{1}{7}\frac{6}{7}\frac{2}{5}$ hours.

Excellent solutions of this problem were received from *G. B. M. Zerr, P. S. Berg, J. K. Ellwood, Cooper D. Schmitt, and J. F. W. Scheffer.*

40. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Find the market-price of $m=3\%$-stock, in order that it may yield $n=3\frac{1}{8}\%$ interest after deducting $d=\$\frac{7}{2\,0}$ from every $S=\$12$.

Solution by the PROPOSER.

According to the conditions of the problem, the deduction from the the par ($100) value of a share is $100d\diagup S$ dollars, $=\$1\frac{5}{8}$; therefore, $100(1-d\diagup S)$ dollars are to yield $\$m$ interest. In order to yield $\$n$ interest,

the market-price must be $P=100\left(\frac{m}{n}\right)\left(1-\frac{d}{S}\right)$dollars, $=\$87\frac{3}{8}$.

COR.—Put $m=n$; then $P=\$97\frac{1}{1\,2}$, which is the correct result of this problem as proposed in the December, '94, MONTHLY.—*F. P. M.*

41. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

If I gain $2 in $5 by selling a horse for $150, what per cent. would I gain by selling the horse for $120?

Solution by P. S. BERG, Apple Creek, Ohio, and the PROPOSER.

Since gaining $2 in $5 is gaining 40%, the cost of the horse is $\$107\frac{1}{7}$. Hence the gain required is 12%.

PROBLEMS.

46. Proposed by T. W. PALMER, Professor of Mathematics, University of Alabama.

A borrows $500.00 from a Building and Loan Association and agrees to pay

$9.50 per month for 72 months, the first payment to be made at the end of the first month. What rate of interest does *A* pay? The Association claims to charge only 8 per cent. (the legal rate in Alabama). How can 8 per cent. be figured out on the above.

47. Proposed by F. P. MATZ, M. Sc., Ph. D., Professor of Mathematics and Astronomy in New Windsor College, New Windsor, Maryland.

Mr. Merchant sells 20% above cost, with weights and measures 12½% "short," allows a discount of $5 on every bill of $50, and loses 5% of his sales as "bad debts." Find his *rate per cent* of net profit, or net loss; one cent in every dollar of sale proves counterfit, and collection-charges are 2½%.

ALGEBRA.

Conducted by J. M. COLAW, Monterey, Va. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

36. Proposed by J. A. CALDERHEAD, B. Sc., Superintendent of Schools, Limaville, Ohio.

Resolve $(x^2+y^1)(x^2+z^2)(y^2+z^2)$ into the sum of two squares.

I. Solution by Professor G. B. M. ZERR, A. M., Principal of High School, Staunton, Virginia.

By Euler's theorem we have

$$(x^2+y^2)(x^2+z^2)=(x^2+yz)^2+(xz\mp xy)^2=A^2+B^2.$$

$$(x^2+y^1)(x^2+z^2)(y^2+z^2)=(A^2+B^2)(y^2+z^2)=(Ay\pm Bz)^2+(Az\mp By)^2$$

$$=\{(x^2\pm yz)y\pm(z\mp y)xz\}^2+\{(x^2\pm yz)z\mp(z\mp y)xy\}^2,$$

$\therefore$ the sum of two squares in four ways.

II. Solution by the PROPOSER.

By determinants we have

$$(x^2+y^2)(x^2+z^2)(y^2+z^2)=\begin{vmatrix} x, -y \\ y, \ x \end{vmatrix}\begin{vmatrix} z, x \\ -x, z \end{vmatrix}\begin{vmatrix} y, z \\ -z, y \end{vmatrix}$$

$$=\begin{vmatrix} xyz-xy^2-x^2z-yz^2, & -x^2y-xz^2-y^2z+xyz \\ x^2y+xz^2+y^2z-xyz, & xyz-xy^2-x^2z-yz^2 \end{vmatrix}$$

$$=(xyz-xy^2-x^2z-yz^2)^2+(x^2y+xz^2+y^2z-xyz)^2,$$

[Other forms can be similarly obtained.—EDITOR].

Also solved by *John Faught, M. A. Gruber, J. Scheffer, and C. D. Schmitt.*

37. Proposed by H. M. CASH, Gibson, Ohio.

The area of the segment of a circle=*c*, and radius=*r*. Find height of segment.